

# The Cognitive Load of Lies

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## **Statement of Sources**

I declare that this report is my own original work and that contributions of others have been duly acknowledged.

Signed:

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### Abstract

Deception is thought to involve greater cognitive load than honesty, and in practice has been shown to increase reaction time (RT). However, this has only been measured with closed-questions delivered by a computer. We employed a dual-task methodology, the Detection Response Task (DRT), to assess cognitive load in a live, open-question interview. The DRT requires participants to press a button in response to a stimulus every 3-5 seconds while simultaneously performing a primary task. In this case, 44 first year Psychology students (29 females) aged 18-66 ( $M = 27.1$  years,  $SD = 10.6$ ) watched 26 short films and constructed and delivered narrative lies about their content to an interviewer. Supporting our hypothesis that deception is cognitively harder than telling the truth, participants were significantly slower to respond to the DRT when constructing ( $M = 385$ , 95%CI[380,391],  $p < .05$ ) and delivering ( $M = 541$ , 95%CI[531,550],  $p < .001$ ) lies in the first half of the experiment. When lying, they were more likely to fail to respond to the stimulus altogether (by 0.3%) and took longer to start answering (by 33 ms). Further inquiry of the DRT in deception research may improve deception theory and refine lie-detection techniques.



Deception is a deliberate attempt to mislead others (DePaulo et al., 2003) and people engage in deceptive behaviours on a daily basis (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). These behaviours range widely, from relatively inconsequential white lies to more serious acts of dishonesty (DePaulo et al., 1996). Serious forms of deception, such as consumer scams, fraud, and theft from Government departments cost Australia upwards of 6 billion AUD per year (Smith, Jorna, Sweeney, & Fuller, 2014). Despite the familiarity of deception and its cost to us, there is no reliable method of detecting it. Detecting deception is challenging for a number of reasons; liars typically display small behavioural differences, deliberately act in ways to appear credible, embed their lies in truthful statements and some are often proficient at delivering lies in a believable way (Vrij, Granhag, & Porter, 2010). These issues have hampered the development of a reliable detection method but so too have the limitations inherent in the theories that attempt to explain deception. The majority of deception theories are driven by two key ideas: that telling lies is harder than telling the truth, and that people behave and speak differently when telling them. The limitations arise when attempting to explain why lying is harder and developing a consensus on how this difficulty is displayed behaviourally.

### **Deception theory**

Early theories emphasised that lying was more difficult because of the emotions involved (Ekman & Frisen, 1969). The effort of trying to hide an emotional response was proposed to result in specific, overt, non-verbal behaviours (changes in micro-expressions in the face and movements in the hands and feet). The accuracy of these behaviours in discriminating deception was entirely anecdotal and no empirical support for these behaviours has yet been established (Vrij & Granhag, 2012).

Later theories moved beyond considering only the emotions involved by incorporating the role of cognition. The first was Zuckerman, DePaulo and Rosenthal's (1981) Four-Factor model of deceptive behaviour. This model proposed that when lying, the emotions, arousal, cognitive effort, and attempts to conceal changes in behaviour were predictive of behavioural differences that would act as 'cues' to deception. The cognitive effort derives from formulating lies that are both internally consistent, and consistent with what the person hearing the lie already knows. The behavioural cues predicted by these four factors included greater pupil dilation, taking longer to respond, hesitating more, and using hand gestures less to illustrate speech.

Building on the Four-Factor model, the Interpersonal Deception Theory (Buller & Burgoon, 1996) emphasised the role of two-way communication during deception. Deception is cognitively taxing because the deceiver must continually monitor their own behaviour and watch for any signs of suspicion from the person being lied to. The variability of goals, expectations, motivations, and relationships between people prevents there being any specific profile of deceptive cues, but deceivers improve with practice (displaying more composure and more fluent speech).

Similarly, the Self-Presentation Theory predicted that liars would be less pleasant and engaging and tell less detailed and compelling lies (DePaulo et al., 2003). This theory emphasised the role of impression management, or a liar's attempts to control the impressions that the receiver makes of them. In developing this theory, they conducted a meta-analytic review of the performance of all previously proposed cues to deception (158 in total). Only 25 per cent of all behavioural cues were associated with deception and of the cues that were, the

average effect size was small ( $d = .25$ ; DePaulo et al., 2003). In follow-up research, Bond and DePaulo (2006) investigated people's accuracy in detecting deception when relying on these cues. They found both lay people and experts (including law enforcement personnel, auditors, and psychiatrists) performed at or below chance level. These results did not trigger an abandonment of these cue-based approaches. Instead, their research influenced a large body of work by Vrij and colleagues (2006) who sought ways to make cues more obvious.

This Cognitive Load Approach involves applying measures that induce cognitive load on liars including making people recount their stories backward (Vrij et al., 2008), surprising them with unanticipated questions and tasks (Vrij, Granhag, Mann, & Leal, 2011), and forcing direct eye contact during interviews (Vrij, Mann, Leal, & Fisher, 2010). The proponents suggest they can detect deception with accuracy rates as high as 71% (Vrij, Fisher, & Blank, 2017). The Cognitive Load Approach has been highly influential, but the authors have neither attempted to explain the cognitive mechanisms involved in the cues detected, nor formalised these ideas into a theory. Further, some authors have argued that the findings of Vrij and colleagues are overstated and go so far as to accuse them of engaging in debatable coding decisions and publication bias (Levine, Blair, & Carpenter, 2017).

These deception theories have progressively built our understanding of deception, but they share a common flaw; while they all point to the role of cognition, none are explicit in describing the cognitive mechanisms involved. This flaw is partially responsible for the unreliability of behavioural cues in detecting deception.

### **Activation Decision Construction Model**

The first to attempt to explain the cognitive mechanisms involved in deception was via the Activation–Decision–Construction Model (ADCM; Walczyk, Roper, Seemann, & Humphrey, 2003). The ADCM relies on constructs from Baddeley’s Working Memory model (1992) and comprises three cognitive components: Activation, Decision, and Construction. The Activation component refers to recall of the truth in long-term memory (LTM), which is transferred to and maintained in working memory (WM). In the Decision component, the decision to lie is based on whether answering truthfully is in their self-interest. The decision to lie guides the central executive (an attention-controlling system; Baddeley, 1992) to inhibit the truth. The Construction component is based on the Construction-Integration Model (Kintsch, 1998), where the truth acts as a retrieval cue to LTM. According to the Construction-Integration Model LTM is thought to consist of a network of semantic and episodic nodes. This network of nodes is drawn on to construct lies. Walczyk and colleagues (2003) argue that access to these nodes takes about 400ms, but their evidence for this estimate is based on an unpublished work. Attention at this stage acts to inhibit the truth, but also inhibits other potential lies that conflict with the social context (i.e., those that are implausible, unverifiable, or inconsistent with what has already been said). Deception, therefore, involves a conscious decision to deceive and constructing a plausible lie that is consistent with the context, all the while suppressing the truth. The model predicts that the cognitive load required to produce a lie results in taking longer to respond.

The model was criticised, not only for its lack of detail, but also for the linear nature in which lie production was said to occur. The decision to deceive is unlikely to occur before a plausible lie is constructed. In light of criticisms, the theory was

updated to the Activation-Decision-Construction-Action Model (ADCAT; Walczyk, Harris, Duck, & Mulay, 2014), which is now one of the most established theories of deception.

### **The Activation Decision Construction Action Model**

ADCAT contains four key components. The Activation component is similar to that in ADCM but is extended to involve receiving signals from the social environment that indicate a truth is required. This can be implicit, such as a police officer approaching the driver side window of a car, or explicit, such as a direct question in a serious tone. At this stage, lying and truth telling are equal in their cognitive effort. Telling the truth only involves this stage, whereas lying involves the following additional components.

The Decision component involves a quasi-rational decision-making process, weighing up the costs and benefits of a variety of truthful and deceitful responses. This includes weighing up the probability and potential consequences of each response. The process is quasi-rational because the analysis of these probabilities is likely inaccurate. The response with the most utility (or perceived utility given the time limit to respond and how clear-headed the person is) is the one chosen. This decision-making process becomes harder in complex or unfamiliar social contexts.

The Construction component involves constructing a plausible, simple narrative that is embellished as necessary. It needs to be detailed enough, and convincing, without adding inconsistencies. The more frequently rehearsal occurs at this stage, the less cognitive load is required at delivery.

The Action component is the delivery of the lie. Cognitive load at this stage increases as the person attempts to appear honest, checks for signs of suspicion from the person being lied to, and inhibits the truth. At this stage, the truth is thought to act

as a Stroop-like interference because honesty is cognitively easier than deception (Pennebaker & Chew, 1985).

ADCAT has significant advantages over earlier theories in that it predicts behavioural cues to deception based on these specific cognitive mechanisms. Such cues include dilated pupils and taking longer to respond (which the authors argue are direct measures of cognitive load) as well as averting eye gaze, which reduces the visual stimuli sent to WM. In response to criticism about the non-linear nature of deceptive discourse, ADCAT assumes the four components occur simultaneously and automatically.

The model also assumes that both the level of rehearsal and the motivation behind deception act as key moderating factors. Rehearsal, involves committing the lie to LTM, anticipating questions regarding the truth, and preparing responses that fit different social contexts. These actions reduce the cognitive load associated with deception. Greater motivation, leads liars to assign more resources to cognitive control, which reduces the exhibition of cues (Walczyk et al., 2014). Walczyk and colleagues (2013) demonstrated that greater rehearsal can reduce cognitive load to below that of telling the truth. While testing the role of rehearsal was straightforward in that study (by assigning participants to either a truth, rehearsed lie, or unrehearsed lie condition), testing the role of motivation is more challenging. Laboratory research can rarely mimic the high stakes that are associated with real-world deception. The consequences of the methods used (usually the risk of losing a monetary reward) do not match the consequences of failing to appear credible in forensic settings.

Indeed, a second school of thought, the motivation impairment hypothesis (DePaulo, Kirkendol, Tang, & O'Brien, 1988), predicts the opposite to ADCAT. The motivation impairment hypothesis predicts that the more motivated the deceiver, the

greater the need to appear credible, increasing stress and the likelihood they will exhibit cues. DePaulo and colleagues (1988) demonstrated this by telling some participants that research shows skilled liars are more intelligent. They then asked participants to use deceit to gain approval when sharing political attitudes with a partner. Those who were convinced that good liars were more intelligent were more likely to display verbal and nonverbal cues to deception (though there was no report of which cues they displayed).

To date, only one study has tested the mechanisms described in ADCAT. Masip, Blandon-Gitlin, de la Riva and Herrero (2016) investigated the Decision component by testing whether people use quasi-rational decision-making when lying. They gave participants hypothetical scenarios and asked them to indicate which of those they would lie or tell the truth about. Participants then rated the consequences of either lying or being honest and the probabilities of those consequences. The results were partially supportive of the ADCAT model; participants made decisions to lie in a quasi-rational way. In contrast to ADCAT, participants only considered the consequences of telling the truth, not of lying. This suggests that the additional load experienced at the Decision component may be smaller than ADCAT predicts.

### **An exception to the rule**

Of all the theories of deception, only one contradicts the consensus that deception is cognitively harder than telling the truth. McCornack, Morrison, Paik, Wisner and Zhu (2014) argue that only when a number of conditions are met would deception be more cognitively demanding. Specifically, they postulate that lies are only harder when they contain the portrayal of complex information, are based on the retrieval of decayed semantic memories, and when there has been no opportunity to rehearse the delivery. They argue these conditions in concert are rare. Instead, they

argue deception only occurs if it is the path of least resistance. Deception is about problem solving, as efficiently as possible using the most easily accessible information. McCornack and colleagues (2014) argue that discourse, be it truthful or deceptive, occurs incrementally, using only brief micro-bursts of attention. These micro-bursts of attention do not induce enough cognitive load to make deception more difficult than honesty.

Critics argue this theory only explains ‘everyday lies’ and is not applicable to ‘high-stakes’ lies, which are associated with more severe personal cost (Walczyk et al., 2014). Yet, the motivations behind both types of lies are similar. Both are told for personal gain, to avoid punishment or to preserve relationships. The critics give no argument for why high-stakes deception requires constant rather than micro-bursts of attention, particularly if they have been well-rehearsed.

### **Detecting Deception**

The above theories have had varying success in explaining why deception may be more difficult than truth telling and the last even rejects the idea. Theory is critical to understanding the continuing challenge of developing reliable detection methods. One example, the infamous polygraph, was developed in isolation from any theoretical account of deception.

The polygraph test has the longest tradition of all deception-detection methods. It measures physiological responses associated with attention, stress and emotion, such as respiration, blood pressure and skin conductance (Meijer & Verschuere, 2015). Historically, results of these responses have been used to infer deceit. Today, it is widely accepted that lying has no unique physiological pattern (Meijer & Verschuere, 2015). The US National Research Council (2003) conducted a large-scale review of the polygraph and recommended against its use. In particular,



their criticisms focussed on a lack of evidence for its reliability. These criticisms failed to eliminate the practice. In Australia, police are permitted to use the polygraph, but any evidence gained is inadmissible in court (s 6(1) of the Lie Detectors Act of New South Wales). Regardless, research into the potential of the polygraph continues (Meijer & Verschuere, 2015).

Equally infamous as the polygraph is the use of the behavioural cues described earlier. Passively observing these behavioural cues is a technique used by law enforcement worldwide, including Australia (Bogaard, Meijer, Vrij, & Merckelbach, 2016a). Of concern, are findings that police officers and the lay public are equally likely to believe in the veracity of cues that have no association with lying (Bogaard, Meijer, Vrij, & Merckelbach, 2016b).

Happily, there is growing evidence that using measures of cognitive workload may assist in developing deception detection techniques. The most direct method of measuring the cognitive effort involved in deception is to simply ask people which they find more difficult. People report that lying is harder (Caso, Gnisci, Vrij, & Mann, 2005). In support of these intuitive findings, there are also a range of indirect measures that support deception being more effortful. For example, functional magnetic resonance imaging (fMRI) studies have found greater activity in brain regions related to cognitive control (such as the prefrontal, parietal, and anterior cingulate cortex; Kozel et al., 2005; Kozel, et al., 2009; Nose, Murai, & Taira, 2009; Monteleone et al., 2009). Sceptics argue that using fMRI is no improvement on the polygraph; fMRI studies have similar predictive ability to the polygraph but involve much higher resources to operate (Spence, 2008).

### **Measuring deception with reaction times.**

Longer reaction time (RT) is associated with an increase in cognitive load, and evidence is growing that RT is a reliable measure of the increased cognitive load associated with deception (Suchotzki, Verschuere, Van Bockstaele, Ben-Shakhar, & Crombez, 2017). Early computerised studies adapted already-established RT paradigms for use in deception research but had disappointing results. For example, in an analogue of the Stroop task, half the participants committed a mock crime, then were given a description of that crime on a screen where every word was coloured one of four colours. Other participants were merely told a crime was committed and were given a description with irrelevant crime details. Participants named the colour of the word as quickly as possible and it was expected that those who committed the mock crime would be more distracted by the description and respond more slowly (Engelhard, Merchelbach, & van den Hout, 2003). They found no significant performance difference between the groups. Another early study used a dual task RT paradigm. After participating in a mock crime, participants were attached to a polygraph machine and viewed a series of either neutral photos or photos of the crime scene. Simultaneously, participants responded to an auditory tone by hitting the 'space-bar' on a keyboard. RTs to the auditory tone were expected to be slower when they coincided with crime scene photos, but no significant difference was observed (Verschere, Crombez, De Clercq, & Koster, 2004). The authors noted their design was limited by very few RT measurements.

More promising results were achieved by studies that developed new deception-specific RT tasks. For example, the reaction time Concealed Information Task asks participants whether they recognise critical details usually about a crime or themselves (Seymour, Seifert, Shafto, & Mosmann, 2000). They are instructed to

hide certain information and to respond to questions either truthfully or deceitfully. Similarly, the autobiographical Implicit Association Test, involves requesting respondents to indicate either TRUE or FALSE to a set of personal statements (Sartori, Agosta, Zogmaister, Ferrara, & Castiello, 2008). The Sheffield Lie Test (Spence et al., 2001) presents 20 statements to which participants are instructed to lie or tell the truth depending on a cue (such as, lie to all questions coloured blue). The time it takes them to respond is assumed to indicate the relative cognitive load involved.

A meta-analysis of these tasks found that overall, deception was associated with a longer average RT than truth-telling, with a mean difference of 115 ms (Suchotzki et al., 2017). Specifically, lying took 49 ms longer in the Concealed Information Task, 149 ms longer in the autobiographical Implicit Association Test, and 180 ms longer in the Sheffield Lie Test. They found a large effect size over 73 studies  $d = 1.26$  after eliminating between-subject designs and correcting for publication bias. They also controlled for the moderating effects of both motivation and rehearsal and found the effect of both was minimal.

### **The limits to measuring deception with RT**

Although these paradigms have promising results, the practice is imperfect. Critics have suggested that RTs are under voluntary control and are therefore unsuitable for lie-detection (Sip et al., 2013). Further, RTs are highly variable, and require a large number of trials for reliability. Suchotzki and colleagues (2017) propose a minimum of 20 observations for each condition. Most of the designs described rarely meet this minimum.

The critical issue is that the methods described only measure the time it takes to produce a binary response either Yes, No, or True, False. The problem with these

responses is that it assumes a model of deception where people produce one of two extremes: a “bold-face lie”, or a “bold-face truth” delivered in one-word answers (McCornack et al., 2014). McCornack and colleagues (2014) argue that few people produce lies in this way. Deception involves covertly violating conversational rules in an indefinite number of ways. More importantly, deception involves producing multiple sentences, not just one-word answers (McCornack et al., 2014). Therefore, these designs do not measure natural lying discourse.

The use of open-ended questions could resolve this problem. Answering an open-ended question should require greater cognitive effort because it involves greater searching of LTM for information (Kintsch, 1998). It also involves all the other load inducing factors in ADCAT’s Construction and Action components such as inhibiting the truth, inhibiting implausible lies, and maintaining a convincing performance.

Walczyk and colleagues (2003) did consider this when testing the original ADCM. They used a between-subjects design, allocating participants to three conditions; lie, tell the truth, or choose to lie or tell the truth to a list of questions. Some questions were closed requiring answers of “yes”, or “no”, such as “do you wear glasses?” and some questions were open requiring an answer of one or two words, such as “where is your favourite place to be romantic?”. These questions are not wholly ‘open-ended’ because the response is one of only a few options and delivered in one-word. A truly open-ended question, for example, “What were you doing the night of April 5?” can elicit a response of multiple sentences. The study found that the time it took people to start answering multiple-response questions took longer than closed questions. In addition, when lying to open questions those who lied to every question and those given the choice to lie, took longer to respond ( $M =$

1274 ms,  $SD = 750$ , and  $M = 1440$  ms,  $SD = 1242$  respectively) than those telling the truth ( $M = 890$  ms,  $SD = 296$ ).

Building on these results, Walczyk and colleagues developed a new, deception-based RT paradigm; Time Restricted Integrity Confirmation (TRI-Con, Walczyk et al. 2005). In their first test of TRI-Con participants were asked 52 questions, of which only eight required a non-binary response (Walczyk, Mahoney, Doverspike, & Griffith-Ross, 2009). Again, the questions described as open-ended only required a response consisting of only a few options. For example, ‘In years, what is your age?’. Such a response can be any number within the limits of the human lifespan, but the response only requires one word. Similar to the 2003 study, the results suggested lying takes longer (on average 230 ms longer).

A later study tested TRI-Con again using different questions (and more accurately referred to open-ended questions as ‘multiple-response’; Walczyk, Griffith, Yates, Visconte, & Sinoneaux, 2013). Nineteen of the 36 questions were multiple response, but again only required a one-word answer – or, at most, a date. In this study, they found unrehearsed liars were significantly slower to respond than truth-tellers to multiple response questions that were relevant to themselves, by 240 ms on average. There were few lie RTs recorded, and exactly how many is unknown. Of the 36 questions, liars were instructed to lie to only nine of them. Of those nine, only six were multiple response and there was no report of how many participants were in each condition.

The cumulative results of Walczyk and colleagues indicate that lying takes longer than telling the truth, but there are limitations in the design of these studies. The first is that the later studies using TRI-Con adopt between-subjects only designs which may lead to generalisation issues. A between-subjects design was unnecessary

because the lie condition only required lie response to nine of 36 questions. All participants could have been assigned to lie to only nine questions. This would help prevent confounding from the myriad individual differences that influence response time including social skills, personality, anxiety during testing, and mental health status (Walczyk et al., 2005). This much was acknowledged by Walczyk and colleagues (2005) in the original study that found a within-subjects design could discriminate between lies and truths with very few questions. It was emphasised in that study the power of a within-subjects design, but subsequent studies by the same team did not heed their own advice.

Another limitation is that the questions were delivered either by computer screen or via an audio recording, even though they could have been asked by an interviewer. Deception occurs within a social context, as do forensic interviews. Using a computer prompt or an audio recording has the benefit of eliminating unwanted variance that comes from interacting with the interviewer. For example, social anxiety would be reduced for those made anxious by being interviewed, but this comes at the cost of ecological validity. If behaviour is socially contextual, it is unlikely behaviours performed in isolation in front of a computer screen entirely reflect the behaviours that would occur in the real world. In addition, many of the proposed load inducing factors described in ADCAT's Action component (e.g., attempting to appear honest, and watching for suspiciousness) would be absent.

The later studies also do not address the issue that yes/no and one-word answers are unlikely to reflect deceptive discourse. None of the RT based deception designs allow for the construction of narrative lies. The designs continue to rely on a bold-face lie/bold-face truth dichotomy. Not only does this model of deception inaccurately reflect real world discourse, it also contradicts the very description of

deception that ADCAT proposes: lies are embellished as needed. The authors of the original ADCM in 2003 argued that trying to build a model of deception based on ‘narrative lies’ would be inappropriate. The length and complexity of narrative lies made accounting for them a “formidable theoretical challenge” (Walczyk, Roper, Seemann, & Humphrey, 2003). To date, no progress has been made in this area.

Finally, these studies only measured how much time it takes for someone to answer a question - or the Action component. In doing so, these designs fail to capture the cognitive load associated with the Decision and Construction components. While ADCAT is the most comprehensive theory of deception and of the few that account for the cognitive processes involved, ADCAT currently relies on findings with considerable limitations.

### **The Present Study**

The present study aimed to address some of these limitations using a new methodology enabling the production of narrative lies in a social context. By introducing the Detection Response Task (DRT) to the deception literature, the present study made it possible to measure RT in both the Construction and Action components of a lie.

The DRT has primarily been used to measure the attentional effects of distraction on drivers and has been found to be a simple and sensitive measure of cognitive workload (Strayer et al., 2015). The DRT measures the cognitive load associated with decision making, sustaining information in WM, and overcoming habitual actions (ISO, 2016), all of which are involved in deception. The DRT involves the presentation of a stimulus (visual, auditory or tactile) every 3-5 seconds to which a person responds by pressing a switch. RTs are calculated from the onset of the stimulus to the response. Greater cognitive load is indicated by slower RTs

and more failed responses to the stimulus. In a 2017 study, participants completed the DRT in three driving related conditions including driving alone in a simulator, talking with a passenger, and driving the simulator while talking on a mobile phone (Tillman, Strayer, Eidels, & Heathcote, 2017). Drivers who conversed with a passenger and on a mobile phone had slower RTs than when driving alone ( $M = 502$ ,  $M = 505$ ,  $M = 466$  respectively). Our aim was to investigate whether the DRT can detect similar cognitive load when constructing and delivering narrative lies.

The design of the present study follows the argument made by Smith and Little (2018); collecting more data points per participant better addresses the limitations of null-hypothesis testing than larger participant numbers. Rather than conduct a formal power analysis the aim was to minimize measurement error by maximising the number of DRT trials, with Castro, Strayer, Matzke and Heathcote (submitted) recommending 200 per participant.

The present study introduced a novel methodology using a series of one-minute short films as stimuli for structured, open questions. We employed a live interview rather than computer-presented questions in order to induce the cognitive load associated with impression management. When participants are prompted to lie, the ADCAT Construction component occurs when watching the film and the Action component occurs when answering questions. As a secondary task, the DRT provides measurements of cognitive load throughout the deception process, allowing us to measure the relative load associated with the Construction and Action components. It was hypothesised that the cognitive demand of constructing narrative lies would result in slower DRT RTs and greater failures to respond to the DRT stimulus (omissions) in both the Construction and Action phases. In addition, RT



was measured using verbal RT (the time to start giving an answer), and it was hypothesised that verbal RT will be greater when lying than when telling the truth.

In keeping with arguments to improve transparency in research, the study was pre-registered on the Open Science Framework (<https://osf.io/jt5pg/>) and the project data has been publicly shared so that others may replicate our results.

## **Method**

### **Design**

The study used a within-subjects experimental design, with two levels of the independent variable (a lying condition and a truth telling condition), and three dependent variables: DRT RT, the number of DRT omissions and verbal RT.

### **Participants**

A stopping rule was applied for data collection for the 10<sup>th</sup> of August due to the volume of data coding required in a fourth-year project. Forty four, first year Psychology students (29 females) aged 18-66 ( $M = 27.1$  years,  $SD = 10.6$ ) were recruited and reimbursed with course credit. One participant failed to construct any lies, so their data was removed, leaving 43 participants. Ethical approval was granted by the Tasmanian Social Sciences Human Research Ethics Committee (Appendix A).

### **Materials**

A tactile DRT device was used, built to conform with ISO standard ISO DIS 17488 (ISO, 2016). The stimulus was a 10mm diameter vibrating motor (running at 5V with a specified RPM of 11000) housed in a 3D-printed casing (14mm diameter by 7mm height). The stimulus was attached to the participant's clavicle with tape. The stimulus vibrated at random intervals ranging from 3-5 seconds with uniform probability. Participants responded to the vibrations with a button (a 6mm

metal tactile ball) housed in a 16mm square 3D printed housing. This housing was strapped to the index finger of their dominant hand with a Velcro strap. The stimulus and response were connected to an Arduino Nano 3.0 compatible microcontroller running custom software which interfaced via serial-over-USB to the experiment application. Timing was millisecond accurate.

The Arduino-based software started and stopped the DRT protocol by managing stimulus triggering and response collection, and then reported events and timing information back to the PC experiment software. The software played, in random order, 26, one-minute long YouTube videos that were submitted as entries to one-minute film competitions. All videos had a coherent story and were screened for explicit content. The experiment software was developed as a C#/WPF .NET application and ran on a Windows 10 PC with a 1920x1080 24" monitor. The movies ran full-screen.

## **Procedure**

Participants were tested individually. After having the task explained to them they read the information sheet (Appendix B), filled out a consent form (Appendix C), and were set-up in a sound-attenuated room. They were fitted with headphones, sat in-front of a monitor and webcam, and fitted with the DRT. Participants were instructed that they could tell lies however they came naturally. They could either produce a narrative that was completely unrelated to the video or take the main themes of the video and change as many details as possible. They were instructed that their lies needed to be convincing and plausible. They were also told they would have to recall some details of their answers at the end in order to mimic real-world situations; lies must be sufficiently memorable so that reporting remains consistent over repeated interrogations.

They were told that the content of the videos was unknown to the interviewer in order to encourage natural lies where the target does not necessarily know they are being lied to. However, the interviewer was responsible for finding and screening the films so was aware of their content. The interviewer was in an adjacent room in front of a webcam enabled computer and interacted with the participant through Skype (Skype for Windows 10, Version 8.18.0.6). The interviewer could not see the participant's screen but throughout the experiment the participant and interviewer's faces were visible to each other. Once all participant questions were clarified they were instructed to follow the prompt on the screen ("Hold down Ctrl, the left arrow for three seconds, and then the space bar to run the next video"; which aimed to prevent them skipping ahead) to start the practice trials.

On the participant's computer, the software presented each video and triggered the activation of the DRT, which ran continuously throughout the experiment. Before each of the videos began a cue appeared on the participant's screen instructing them to either lie or tell the truth (e.g., "After the following movie, please tell the **truth** when you reply to the questions."). At the end of each movie a cue appeared ("Now signal to the interviewer that the movie has finished") with either **Truth** or **Lie** in bold at centre screen. The interviewer then asked, "Please describe as quickly as possible in as much detail as possible, what occurred in the video". Once the answer was completed the interviewer asked: "As quickly as possible in as much detail describe the main character". They were given feedback such as "that level of detail is fine". Or, if the response was only one sentence, the participants were instructed to "remember to provide as much detail as you can". The interviewer then asked the participants to follow the screen prompts to begin the experimental trials which were of the same format.

Sometimes the lies told required the interviewer to alter the question, such as “Can you describe one of the characters?” or, if they had described the characters in detail in the first response, “Can you describe what they were wearing?”. There were no further prompts throughout the experiment. Two questions were asked in order to increase the number of verbal RT measures, ensuring there were at least 20 per condition, and also to ensure a sufficiently long narrative for the DRT measurements.

The main experiment consisted of thirteen true and thirteen lie trials that were randomly ordered, except that after two consecutive lie or truth trials the software always switched to the alternative. A rest break occurred after trial fourteen. After the final trial participants were asked to recall details given at the trial that occurred before the break and the final trial (e.g., what was the person wearing). Their responses to these questions were not recorded as the instruction to make them memorable was only to encourage compliance in producing plausible lies. In addition, each participant gave unique lies, so quantifying how well they remembered them would be difficult. The total length of the experiment averaged 75 minutes.

Participants then rated three statements, over five levels from strongly disagree to strongly agree, that it was more difficult to tell lies than the truth, that they were motivated throughout the task, and that they focused more on the DRT than answering questions (see Appendix D). These questions were asked to determine three things; how difficult the subjective experience of telling lies was in this experiment, whether participants felt motivated to tell convincing lies, and to determine if participants consciously focussed more attention on the DRT task than the interview.

## **Response Coding**

All analyses used R (R Development Core Team, 2016). The DRT RTs were time-locked to the trials by referencing the computer clock readings for each DRT response saved in the DRT data file. Verbal RTs were coded using sound files in Adobe Audition (Adobe Systems 2018, version 11.1.1.3). By examining the waveforms for each trial, the RTs were calculated by manually marking the gap between speech at the end of the interviewer's question and the beginning of the participant's answer.

## **Results**

Participants gave a variety of lies, from as little as changing the gender of the main character to constructing wholly new narratives. Following the ISO standard (ISO, 2016), all DRT RTs faster than 100 ms (1.2% of all responses) and slower than 2.5 secs (1.2% of all responses) are considered anticipations or omissions and were excluded. All data during the practice trials and session break were removed as were the RTs immediately before the onset of each movie (as participants had to hold down several buttons, which disabled their ability to respond to the DRT).

Responses were divided into two blocks, First Half (before the break) and Second Half (after the break) and entered as fixed effects in order to test for effects of practice and fatigue. DRT responses were also divided into 'lie phase', either Construction (when watching the movies) or Action (when delivering the lie), to test for different workload effects consistent with ADCAT and analysed as fixed factors. In all analyses the 43 participants and 26 movies were included as additive random effects.

During the experiment the DRT motor was replaced after malfunction, raising the possibility that the amplitude of the stimulus it provided may have

changed. As stimulus intensity can affect RT (Luce, 1986) we performed additional analyses adding a between-subject factor, grouping participants run before and after the change and found it did not participate in any significant effects.

DRT RT and verbal RT were analysed using linear mixed-effect models with the R package *lme4* (Bates, Maechler, Bolker, & Walker, 2014). Inferential analyses of all RT data used a Gaussian error model, so RTs were logarithmically transformed before analysis. For DRT omissions, a generalized linear mixed model was used assuming a binomial error model and a probit link function. All effects were assessed using a Type II Wald chi-square test as implemented by the R *car* package (Fox & Weisberg, 2011). Since we use a common and familiar unit of measurement (time) we report simple effect sizes as mean differences and report 95% confidence intervals to indicate a plausible range of that effect (Baguley, 2009).

There were 35362 DRT responses collected across all 43 participants, with an average of 822 tactile stimuli events per subject. A visual inspection of histograms confirmed all participants DRT RTs were positively skewed as expected.

**DRT RTs**

Table 1.

*DRT RT main and interaction effects*

	Mean (ms)	95% CIs	Difference
Truth	440	438-443	-
Lie	447	445-449	7ms***
Construction	387	382-393	-
Action	528	520-536	141ms***
First Half	437	433-442	-
Second Half	452	447-456	15ms***
<i>Lie phase x Block</i>			
- First half Construct	381	375-387	-
- Second half Construct	395	390-401	14ms*
- First half Action	524	516-532	-
- Second half Action	535	527-544	11ms*
<i>Lie condition x Block</i>			
- First half Lie	443	438-448	12ms**
- First half Truth	431	427-435	-
- Second half Lie	452	447-448	0ms
- Second half Truth	452	447-456	-
<i>First half Lie condition x Lie phase</i>			
- Construct Lie	385	380-391	8ms*
- Construct Truth	377	371-383	-
- Action Lie	541	531-550	31ms***
- Action Truth	510	502-517	-

Note \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

As per Table 1, RTs were significantly slower when lying than when telling the truth  $\chi^2(1) = 31.39, p < .001$  indicating higher load in the lie condition than the truth condition. RTs were also significantly slower in the Action phase than in the Construction phase,  $\chi^2(1) = 4441.18, p < .001$ , indicating much higher load for reporting than constructing narratives. RTs were slower in the second half of the experiment  $\chi^2(1) = 30.90, p < .001$  indicating a fatigue effect. These main effects were qualified by a number of significant interactions. The interaction between lie phase and block showed slowing in both the Action and Construction phases in the second half,  $\chi^2(1) = 6.27, p = .01$ , further indicating a fatigue effect. The difference in the interaction between block and lie condition  $\chi^2(1) = 10.32, p = .001$ , was in the

first half, indicating that the load of lying decreased with practice. In light of these findings we tested our hypotheses separately for each block.

In the first half RTs in the lie condition were significantly slower than the truth condition both in the Construction,  $\chi^2(1) = 6.3, p = .012$ , and Action,  $\chi^2(1) = 38.4, p < .001$ , phases. In contrast, neither effect was significant in the second half,  $\chi^2(1) = 0.2, p = .64$  and  $\chi^2(1) = 1.55, p = .21$ , respectively.

### DRT omissions

Table 2

#### *DRT omission main and interaction effects*

	% missed	95% CIs	Difference (% point)
Truth	3.6	2.3-5.4	-
Lie	3.9	2.4-5.9	0.3***
Construction	2.1	1.4-2.9	-
Action	6.2	4.2-8.8	4.1***
First Half	3	2.0-4.6	-
Second Half	4.5	2.9-6.8	1.5***
<i>Block x Lie interaction</i>			
- First half Truth	2.8	2.0-3.8	-
- First half Lie	3.3	3.0-4.7	0.5**
- Second half Truth	4.6	3.2-6.3	-
- Second half Lie	4.4	3.0-6.2	0.2
<i>Lie x Construct interaction</i>			
- Construct Truth	2.2	1.6-3.0	-
- Construct Lie	2	1.5-2.5	-0.2
- Action Truth	5.5	4.1-7.4	-
- Action Lie	7	5.2-9.2	1.5***

Note \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

As per Table. 2 the DRT omission rates were consistent with the main effects of RT with significant main effects of lie condition,  $\chi^2(1) = 12.94, p < .001$ , of block,  $\chi^2(1) = 156.25, p < .001$ , and of lie phase,  $\chi^2(1) = 932.18, p < .001$ . There was also a significant interaction between lie condition and block  $\chi^2(1) = 7.61, p < .01$ , similar to RT, the effect of lie condition in the first half,  $\chi^2(1) = 18.26, p < .001$ , disappeared in the second half,  $\chi^2(1) = 0.60, p = 0.440$ , during the Construction phase. Similarly,



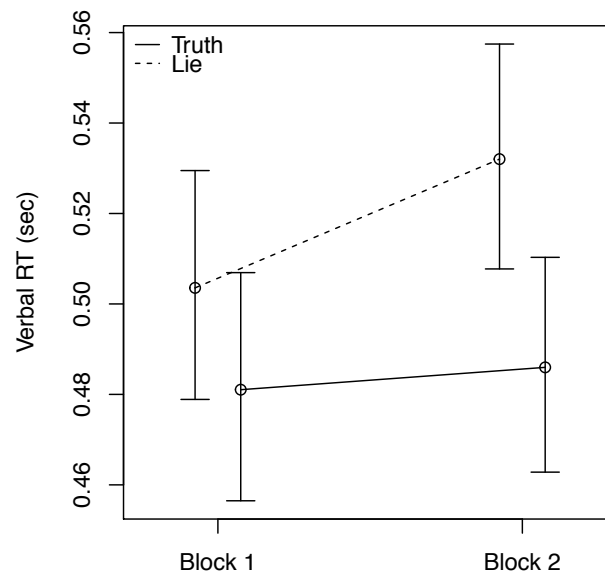
in the Action phase, the effect of lie in the first half  $\chi^2(1) = 27.81, p < .001$ , reduced considerably in the second half,  $\chi^2(1) = 4.62, p = 0.03$ , giving a stronger indication that the load of lying decreased with practice. There was a similar effect to RT between lie condition and lie phase,  $\chi^2(1) = 14.42, p < .001$ , indicating the effect of load was most marked when actioning a lie.

### **Verbal RT**

One participant answered the questions before the interviewer finished speaking, so no discernible break in speech pattern could be identified and their data was excluded. The audio recording failed for another, so data from 41 participants were analysed. No censoring was performed on the verbal RT data as participants could prepare their answer while listening to the question and anticipate when it finished, so very fast responses are plausible. Similarly, slow responses are plausible, and they were not overly influential because the analysis was performed on a logarithmic scale where verbal RT distribution was approximately normal. Most participants had the maximum number of valid verbal RTs, 52, with one having 45 and another 50.

Participants were slower to initiate a response when lying ( $M = 516$ , 95%CI[486,548]) than telling the truth ( $M = 483$ , 95%CI[454,514]),  $\chi^2(1) = 7.60, p = .006$ . As shown in Figure 1, participants were slower to initiate a response in the first (Block 1) and second (Block 2) halves of the experiment when lying than telling the truth. However, neither the block effect nor the interaction of block and lie condition were significant.

*Figure 1* Mean verbal RT for true and lie responses during the first (Block 1) and second (Block 2) half of the experiment.



Means and within-subject standard errors (Morey, 2008) were calculated on the logarithmic scale for RT and the resulting points and intervals transformed back to the natural scale for graphing.

### Questionnaire

The majority of participants (41.8% agreed and 37.2% strongly agreed) agreed that it was subjectively more difficult to lie than recall the truth and that they were motivated to give convincing answers (90.5% either agreed or strongly agreed). The majority also disagreed (51% disagree, 25.8% strongly disagree) that they consciously focussed more attention on the DRT task than the interview.

### Discussion

The aim of this research was to investigate whether the DRT can detect the cognitive load associated with constructing and delivering narrative lies. Data from our experiment very strongly supported our hypothesis that the production of narrative lies increases cognitive load, both in the form of slowed responses and response omissions to the DRT, and the time it took to initiate a verbal response. Participants also reported that lying felt harder. These results are consistent with the

deception literature which is dominated by the idea that lying is harder than telling the truth.

For some time, the evidence has been building that RT, as a measure of the cognitive load involved in lying, can be a reliable measure of deception. However, the majority of research to date has tested this assuming lies are produced in only one way: as bold-faced lies. These are usually delivered dichotomously as yes/no, or true/false. This structure fails to capture the myriad ways in which lies occur. Lies are often narratives that contain mostly truth, and a little deceit. Designing studies with questions that only require a dichotomous answer fails to capture deception in full. The present results help bridge this gap by indicating that narrative lies also take longer.

To date, inferences about the cognitive load of deception have been made based wholly on the delivery of lies, or RT in the Action component of ADCAT. Our methodology enabled us to detect the particular load associated with the construction of those lies. Consistent with previous findings (Spence et al., 2001; Sartori et al., 2008; Walczyk et al., 2009; Suchotzki et al., 2017), participants were slower to respond to the DRT when actioning a lie than actioning the truth (by 31 ms on average) in the first half of the experiment. Although in the Construction phase we found a significant difference between lying and telling the truth that difference was small and was eliminated with practice. The role of practice may have contributed in several ways.

Rehearsal during the Construction phase is predicted to be a strong moderator of deception RT (Walczyk et al., 2014). Greater rehearsal over time is associated with faster RT whereas limited rehearsal is associated with slower RT. In the current study, for every video, the questions were the same “please describe what happened,

and please describe what the main character looked like”. Once familiar with the task it is possible that when prompted to lie, participants engaged in effective rehearsal of responses to the anticipated questions rather than focus on watching the videos. This level of rehearsal may have been enough to reduce the cognitive load evident in the first half of the experiment.

Perhaps the practice effect is indicative of reduced anxiety. Some of the cognitive load involved in deception comes from anxiety during questioning (Walczyk et al., 2005). The second half of the experiment occurred after a rest that for most participants involved chatting with the interviewer. Building rapport at the half-way mark coupled with familiarity with the task over time, may have reduced the cognitive load related to anxiety.

Relative to the load evident in the Action component, it is tempting to conclude that the Construction component adds limited additional load to the deception process. However, the difference may be due to the type of construction required in this experiment. One aspect of constructing a plausible lie is not giving away information the target would know to be false. Our paradigm did not require this of participants. The interviewer and participants are unknown to each other and participant believe the interviewer is blind to what they are watching. There is therefore no need to try and inhibit information that would be inconsistent with what the target knows. Therefore, lie construction in this paradigm may be easier than is usually the case. Future designs would need to incorporate an interviewer having some prior knowledge about an incident/topic and manipulate the level of rehearsal available to participants to determine the full load associated with the construction of lies.

Verbal RT was slower when lying, but participants only took on average 33 ms longer than when telling the truth. This is vastly smaller than the 336 ms reported by Walczyk and colleagues (2003) in their first attempt to measure ‘open-ended’ RTs. This may be due to the significant differences between the designs of that experiment with the current study. Critically, the present study involved producing narrative lies to an interviewer. There may be linguistic factors that influence the speed of response. For example, the use of speech fillers such as ‘uh’ and ‘um’ which give us space to decide, construct, and rehearse our speech. These were treated equally to all other words that began their speech. Past research has found that greater occurrences of and longer ‘um’s’ are discriminative of truth-telling (Arciuli, Mallard, & Villar, 2010). It may be worth considering excluding speech fillers when calculating verbal RT.

Or, the social context of telling a lie to a person, rather than a computer may influence response time. Our paradigm used a live interview to induce the load associated with impression management. Although all modern deception theories emphasise the social nature of lying, all RT paradigms so far deliver their questions via a computer. The cognitive load induced by impression management should result in RTs greater than those achieved by lying to a computer. Our results do not support this, but our design was not truly social. The interaction between participants and interviewer was mediated by the computer through the use of Skype. This semi-social design resulted in one participant’s data being removed due to failing to conform to the reciprocal rules of communication – they interrupted the interviewer to answer as quickly as possible (as was their instruction). In a truly social context, this would result in an awkward exchange where the target may start to show signs of suspicion. Future research may want to consider designs that mimic an actual

interview context on opposite sides of a desk to determine the strength that social influences play on deception RT. In addition, that design should include open-ended question, and incorporate the elements of prior knowledge and rehearsal discussed earlier. It may be possible to detect reliable differences with such a design in a much shorter experiment than the current study. By the half way point, most participants had been in the experiment for approximately 40 minutes which resulted in pervasive fatigue effects from the first half to the second half of the experiment.

The results of the present study contradict McCornack and colleagues (2014) assertion that lying is rarely more demanding than truth telling. According to their theory, lies are only harder when they contain the portrayal of complex information, are based on the retrieval of decayed semantic memories and are unrehearsed. To some extent, the lies told in this study reflect these three conditions. The lies in this study were minimally rehearsed and it is possible that some of the lies told rely on old semantic memories. Many participants constructed lies that were wholly unrelated to the videos. It is likely that in the construction of these lies, participants were drawing on memories of their personal experiences. It is less clear whether the information portrayed was complex, simply because McCornack and colleagues do not define complex in their theory.

Take for example the following, given as a lie, which did not reflect any of the videos in the experiment:

There was a little girl I think it is her birthday party and her dad invited his friend who is a famous singer to join the party. The singer went to their house and gave her some presents, and he suggested he could set up some decorations and started to blow up some balloons. But, suddenly he had a heart attack and he died on the floor. Everyone wondered what they should

do with the dead body and realised that they should try and capture his last breath because he's worth a fortune (because he's very famous) so they try and protect the last balloon he blew up.

Arguably, this portrays a complex narrative. It may be that lies are typically no more cognitively difficult than telling the truth, but that our design captured exactly those lies that are.

### **Limitations**

The interviewer was not blind to the content of the videos. It is possible that the interviewer's attempts at lying to convince participants of this (e.g., laughing along when recalling a funny narrative, and acting surprised by a surprising twist that was no surprise) impacted the results in some way. If the interviewer was not convincing, the participants may have been suspicious and consequently assign fewer cognitive resources to appearing convincing themselves. Future studies should aim for a double-blind design where lie stimuli are as new to the interviewer as the participants.

What this study did not measure is the decision to lie which forms a major part of why lying is more cognitively demanding. According to Walczyk and colleagues (2014), the Decision component is the most important and involves a complex quasi-rational decision-making process. One previous study found support for this process (Masip et al., 2016), but concluded that the Decision component may not account for as much cognitive load as ADCAT predicts. In the present study, participants were instructed when to lie and when to tell the truth. This was to ensure an even number of trials per condition. Therefore, no study has tested the relative cognitive load associated with this phase of deception. Follow up research could easily adapt the current paradigm to allow participants the choice to engage in this

decision-making process. In doing so, it may be possible to determine the relative contributions of each ADCAT component to the cognitive load experienced when lying. The challenge will be motivating participants to lie. For example, in Walczyk's original study, of those who had the choice of lying or telling the truth, the choice to lie only occurred 22% of the time.

The role of motivation in deception is controversial and it is difficult to quantify. We are unable to determine if motivation played a role in reducing RT (as would be suggested by assigning greater resources to executive functioning to give convincing lies) or increasing it (as suggested by the motivation impairment effect where the greater the motivation to seem convincing induces greater stress) because there were no consequences for failing to lie convincingly. Laboratory-based studies are limited in their ability to induce the high-stakes that occur in criminal investigations. Indeed, Suchotzki and colleagues (2017) found that motivation was not a key moderating factor in deception RT which may be explained by the low-stakes involved. In this study, participants were instructed to give as convincing lies as possible and more than 90% stated they were motivated to do so. Since the role of motivation remains debated in this field, future research could incorporate the DRT while manipulating the level of motivation to determine its relative contribution to the cognitive load of deception.

### **Implications**

Can the DRT be used for lie detection? It is a relatively cheap design to build (relative to an fMRI machine) and transport so it would be easily deployable in ecological contexts. However, the differences between lying and truth telling here were quite small and highly reliant on a large number of RT measurements. In addition, using a device such as the DRT to detect deception would be vulnerable to



countermeasure. RT are under voluntary control (Sip et al., 2013) and participants in our study were unaware that their responses to the DRT were more important than producing plausible lies. If slow responses to the DRT were known to infer guilt, participants could try to confound their RT results by making consistently slow responses. It is unlikely the DRT is the next lie-detection tool.

What dual-task methodologies like the DRT can provide is a concrete grounding for the concept of cognitive load. This grounding could be particularly useful in assessing the influential Cognitive Load Approach to lie detection. This approach attempts to make involuntary signs of lying more evident through manipulations that putatively increase cognitive load, such as recounting stories backward (Vrij et al., 2008), unanticipated questions and tasks (Vrij, Granhag, Mann, & Leal, 2011), and forcing direct eye contact during interviews (Vrij, Mann, Leal, & Fisher, 2010). The DRT could provide a rigorous way to assess which of these manipulations increases the cognitive load of lies relative to honest responses.

The present study has made several important contributions. To the cognitive view of deception more generally, our results support the argument that lying is harder than telling the truth. In addition, the RT deception effect is not restricted to computerised ‘yes/no’, ‘true/false’ paradigms: it also applies to narrative lies. Until now, all inferences made about the cognitive load involved in lying has been based solely on a model that poorly reflects deceptive discourse. This study demonstrates that narrative lies in terms of RT are not the formidable theoretical challenge proposed. It also provides a modest, but significant step toward validating the Construction component of ADCAT. Until now, only the contribution of the Action component to the time it takes to lie had been tested. The temporal nature of the DRT made this possible. This study validates the DRT as a sensitive measure of cognitive

load in a new applied setting. As a cheap to build, transportable device, the DRT has vast potential in improving not only our theoretical understanding of deception but also refining lie-detection techniques.

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## Appendices

### Appendix A: Ethics approval letter

Dear Professor Heathcote

Re: MINIMAL RISK ETHICS APPLICATION APPROVAL Ethics Ref: H0017327 -  
Multitasking and Deception

We are pleased to advise that acting on a mandate from the Tasmania Social Sciences HREC, the Chair of the committee considered and approved the above project on 22 May 2018.

This approval constitutes ethical clearance by the Tasmania Social Sciences Human Research Ethics Committee. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities is required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

Please note that this approval is for four years and is conditional upon receipt of an annual Progress Report. Ethics approval for this project will lapse if a Progress Report is not submitted.

The following conditions apply to this approval. Failure to abide by these conditions may result in suspension or discontinuation of approval.

1. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval, to ensure the project is conducted as approved by the Ethics Committee, and to notify the Committee if any investigators are added to, or cease involvement with, the project.
2. Complaints: If any complaints are received or ethical issues arise during the course of the project, investigators should advise the Executive Officer of the Ethics Committee on 03 6226 7479 or [human.ethics@utas.edu.au](mailto:human.ethics@utas.edu.au).
3. Incidents or adverse effects: Investigators should notify the Ethics Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
4. Amendments to Project: Modifications to the project must not proceed until approval is obtained from the Ethics Committee. Please submit an Amendment Form (available on our website) to notify the Ethics Committee of the proposed modifications.
5. Annual Report: Continued approval for this project is dependent on the submission of a Progress Report by the anniversary date of your approval. You will be sent a courtesy reminder closer to this date. **Failure to submit a Progress Report will mean that ethics approval for this project will lapse.**
6. Final Report: A Final Report and a copy of any published material arising from the project, either in full or abstract, must be provided at the end of the project.

Yours sincerely

Ethics Officer  
Tasmania Social Sciences HREC

## Appendix B: Information Sheet



Participant Information Sheet 2, 10 July 2018

## **Multitasking and Deception**

This information sheet is for participants

### **1. Invitation**

You are invited to participate in the above research project, which is being conducted by Professor Andrew Heathcote (supervisor), Ms Lisa Bird (honours student) of the School of Psychology at The University of Tasmania and Mr Robert Cockerell a Forensic Expert with KordaMentha. This project will form part of Ms Bird's honours thesis and has been approved by the Human Research Ethics Committee.

### **2. What is the purpose of this study?**

The purpose of this study is to determine if the Detection Response Task (DRT) – a device that measures how hard the brain is working – can be used to detect deception.

### **3. Why have I been invited to participate?**

As a first year Psychology student listed on SONA your name has been identified as someone willing to participate in research in return for course credit. Your involvement is voluntary, there are no consequences if you decide not to participate and this will not affect your grade or relationship with the University.

### **4. What will I be asked to do?**

If you agree to participate, you will be asked to watch a series of short videos and be interviewed about their content. There will be 26, one-minute videos in total and after each you will be instructed to either lie or tell the truth about their content to an interviewer. Simultaneously, you will be asked to respond as quickly as you can to a switch in your hand, every time a buzzer goes off on your chest. You will get a practice run at completing these simultaneous tasks before the test starts. Once complete you will be asked to complete a short questionnaire and also recall some of the details of the videos that you saw.

You will be set up in front of a webcam and microphone and video and audio recordings of the whole task will be taken in order to transcribe and analyse your responses. Your participation will require approximately 90 minutes.

### **5. Are there any possible benefits from participation in this study?**

In return for your participation you will be eligible to claim 1.5 hours course credit for KHA101/KHA102. In addition, you will go in the draw to win 1 of 4 \$50 Coles/Myer giftcards. More broadly, your contribution will help build an understanding of deceptive behaviour.

### **6. Are there any possible risks from participation in this study?**

We do not foresee any risks to you if you choose to participate. It is possible the task may cause fatigue; you are encouraged to take a break when prompted.

### **7. What if I change my mind during or after the study?**

Please be advised that your participation in this study is completely voluntary. Should you wish to withdraw, you may do so at any time without giving an explanation. After the experiment, if you wish to withdraw your data, you may do so without explanation. Please inform the researchers that you want to withdraw your data by Friday 10<sup>th</sup> August 2018. Your decision to withdraw will not impact your SONA credit, or chance to win a voucher. Please note that your face will be visible in the video recordings, but your name will not be attached to the video in any way.



*Participant Information Sheet 2, 10 July 2018*

**8. What will happen to the information when this study is over?**

We intend to protect your anonymity and the confidentiality of your responses to the fullest possible extent. As part of the analysis we intend to employ three independent raters from Amazon Mechanical Turk – a service that allows the outsourcing of technical work. They will receive voice data files to code but will not know or be able to determine to whom the data belongs. The video recordings will be reviewed by a forensic expert. He will see your face but will not know your name or any other information about you.

We intend to share the audio data (not the video recordings) using the Open Science Forum which allows other researchers to use it in the future. None of this data will have any identifying information and cannot be linked back to you. However, it is important that you understand your data may be used by others in future, unrelated research. If you would like more information about Open Science Forum, please check out: <https://osf.io/>

By signing the consent form you are consenting to your data being collected for the current study AND being made available on the OSF site. If you do not want your data made available to other researchers on the OSF site, please do not participate in the study, or if you change your mind please inform the researchers and any data collected up to that point will be securely deleted.

Your entry to win 1 of 4 \$50 Coles/Myer ~~giftcards~~ occurs completely separately from your data. At the end of the experiment, to enter you may provide your contact details into a draw and winners will be notified by 1 November 2018.

**9. How will the results of the study be published?**

Once the thesis arising from this research has been completed, a brief summary of the findings will be made available by researchers upon application. The thesis will be accessible through the University of Tasmania library catalogue search function and the results of the study will be viewable. It is also possible that the results will be presented at academic conferences. A summary of results will be available via the following link: <https://osf.io/jt5pg/files/> by the first week of December. You will not be identifiable in the publication of the results.

**10. What if I have questions about this study?**

Should you require any further information, or have any concerns, please do not hesitate to contact the researchers; Ms Bird: 03 6226 1763, [l.a.bird@utas.edu.au](mailto:l.a.bird@utas.edu.au), Professor Heathcote 03 6226 1763.

If you would like to participate, please indicate that you have read and understood this information by signing the accompanying consent form.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on +61 3 6226 6254 or email [human.ethics@utas.edu.au](mailto:human.ethics@utas.edu.au). The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H17327.

**Thank you for your time. This form is for you to keep.**



## Appendix C: Consent form



Participant Consent Form 1, 17 May 2018

**Multitasking and Deception**This consent form is for participants.

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves a 90 minute computer-based task and that video and audio recordings of me will be taken in order to transcribe my responses.
5. I understand that the audio data will be analysed by independent ~~raters~~ outsourced through Amazon Mechanical Turk, and the video data analysed by an expert from outside the University of Tasmania.
6. I understand that participation involves no foreseeable risks other than fatigue.
7. I understand that all research data will be securely stored on the Tasmanian Cognition Laboratory premises for five years from the publication of the study results, and will then be destroyed unless I give permission for my de-identified electronic data (reaction times and audio recordings) to be made available to other researchers on an Open Science Framework site indefinitely.  
I agree to share my study data with the Open Science Framework.  
Yes ☐ No ☐
8. Any questions that I have asked have been answered to my satisfaction.
9. I understand that the researcher(s) will maintain confidentiality and that any information I supply to the researcher(s) will be used only for the purposes of the research.
10. I understand that the results of the study will be published so that I cannot be identified as a participant.
11. I understand that my participation is voluntary and that I may withdraw participation at any time without any effect, and withdraw my data up until the 10<sup>th</sup> August 2018.

Participant's name: \_\_\_\_\_

Participant's signature: \_\_\_\_\_

Date: \_\_\_\_\_



*Participant Consent Form 1, 17 May 2018*

**Statement by Investigator**

☐

I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐

The participant has received the Information Sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project.

Investigator's name: \_\_\_\_\_

Investigator's signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix D: Questionnaire

Please indicate how much you agree with the following statements:

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Undecided</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>It was more difficult to construct the lies than to tell the truth:</b>					
<b>I was motivated to give convincing answers throughout the task:</b>					
<b>I focussed more attention on the buzzer than responding to the questions:</b>					